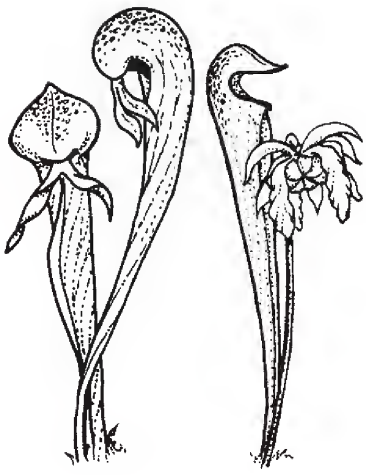
CARNIVOROUS PLANT NEWSLETTER

Journal of the International Carnivorous Plant Society

Volume 42, No. 3 September 2013



CARNIVOROUS PLANT NEWSLETTER

Journal of the International Carnivorous Plant Society
www.carnivorousplants.org

Volume 42, Number 3
September 2013

Front Cover: Eric Green in the field at the Fernkloof Nature Reserve near the town of Hermanus, South Africa, in July 1997. Photo by R. Gibson. Article on page 76.

Back Cover: Bob Hanrahan at the Coalmine Beach *Cephalotus* site near Walpole, Western Australia, in July 2007, showing the plants growing on steep angles of the hills. Photo by Phill Mann. Article on page 87.

Carnivorous Plant Newsletter is dedicated to spreading knowledge and news related to carnivorous plants. Reader contributions are essential for this mission to be successful. Do not hesitate to contact the editors with information about your plants, conservation projects, field trips, or noteworthy events. Advertisers should contact the editors. Views expressed in this publication are those of the authors, not the editorial staff.

All correspondence regarding dues, address changes and missing issues should be sent to the Membership Coordinator at the ICPS. Do not send such correspondence to the editors. Checks for subscriptions should be made to the ICPS in US funds. Dues for 2013 are $35 for the first year of membership; renewals are $30 per year.

International Carnivorous Plant Society, Inc.
2121 N. California Blvd., Suite 290
Walnut Creek, CA 94596-7351, USA
icps@carnivorousplants.org

President	Michael Baldwin, michael@carnivorousplants.org
Vice President	Marcel van den Broek, marcel@carnivorousplants.org
Secretary/Treasurer	Richard Myers, richard@carnivorousplants.org
Board Member	Brian Barnes, Conservation Director, brian@carnivorousplants.org
Board Member	Richard Nunn, richardnunn@carnivorousplants.org
Board Member	Jan Schlauer, jan@carnivorousplants.org
Board Member	Bob Ziemer, bob@carnivorousplants.org
Administrator	Cindy Slezak, cindy@carnivorousplants.org
Seed Bank Manager	John Brittnacher, john@carnivorousplants.org
CPN Editors	editor@carnivorousplants.org
Managing Editor	Bob Ziemer
Editor	Barry Rice
Science Editor	Fernando Rivadavia
Science Editor	Jan Schlauer

Date of effective publication of the June 2013 issue of Carnivorous Plant Newsletter: 30 May 2013.

The ICPS is the International Cultivar Registration Authority (ICRA) for the names of cultivated carnivorous plants according to the International Code of Nomenclature for Cultivated Plants. Send relevant correspondence to the ICPS, Inc.

Carnivorous Plant Newsletter is published quarterly in March, June, September, and December by the ICPS, Inc., 2121 N. California Blvd., Suite 290, Walnut Creek, CA 94596, USA. Periodicals postage paid at Richmond, CA and additional mailing offices. Postmaster: Send address changes to ICPS, Inc., 2121 N. California Blvd., Suite 290, Walnut Creek, CA 94596, USA. Printed by Allen Press, Inc., 810 E. 10th Street, Lawrence, KS 66044. Logo and masthead art: Paul Milauskas.
© 2013 Carnivorous Plant Newsletter. All rights reserved. ISSN #0190-9215

Contents

Farewell Eric Green ---- 76
Announcement: 2014 ICPS Conference ---- 82
Drosera ericgreenii – Eric Green's sundew ---- 83
Bob Hanrahan ---- 87
The Savage Garden: Bob Hanrahan ---- 88
Memories of Bob Hanrahan ---- 92
Erratum: The correct name for the hybrid butterwort *Pinguicula grandiflora* subsp. *rosea* × *P. vulgaris* ---- 93
A short history of an exotic carnivorous planting in New Jersey, USA ---- 94
Phylogeny and biogeography of the Sarraceniaceae ---- 99
New cultivars ---- 107
Book review: *Dionaea* The Venus's Flytrap ---- 110

From the Editor

Recently another two members of our CP community passed on and are remembered in this issue of CPN. Below is a fitting tribute to Eric Green (1948-2013) and Bob Hanrahan (1946-2013).

An old man going a lone highway
Came at the evening cold and gray
To a chasm vast and deep and wide.
The old man crossed in the twilight dim
The sullen stream had no fear for him
But he turned when safe on the other side
And built a bridge to span the tide.
"Old man," said a fellow pilgrim near
"You are wasting your strength with building here.
"Your journey will end with the ending day
"You never again will pass this way.
"You've crossed the chasm deep and wide
"Why build you this bridge at evening-tide?"
The builder lifted his old gray head.
"Good friend, in the path I've come", he said
"There followeth after me today,
"A youth whose feet must pass this way.
"This chasm that has been as naught to me
"To that fair-haired youth may a pitfall be.
"He, too, must cross in the twilight dim
"Good friend, I'm building this bridge for him."

—Will Allen Dromgoole (1860-1934)

Each is given a bag of tools,
A shapeless mass,
A book of rules;
And each must make—
Ere life is flown—
A stumbling block
Or a steppingstone.

—R. L. Sharpe (1870-1950)

Bob Ziemer
Managing Editor

Farewell Eric Green

Thomas Carow • Uempfigstrasse 5 • D-97720 Nuedlingen • Germany
Christian Dietz • Bahnhofstrasse 41 • D-35440 Linden • Germany • dietz@utricularia.de
Andreas Fleischmann • University of Munich (LMU) • Systematic Botany and Mycology • Menzinger Strasse 67 • D-80638 Munich • Germany • fleischmann@lrz.uni-muenchen.de
Robert Gibson • 5 Kristen Close • Cardiff Heights • NSW, 2285 • Australia • robert.gibson@environment.nsw.gov.au
Fernando Rivadavia • Daniel Burnham Court #519 • San Francisco • CA, 94109 • USA • fe_riva@uol.com.br

Eric Green was a well-known carnivorous plant enthusiast extraordinaire who has left a lasting-legacy on the world of carnivorous plants. Not only has he greatly increased the knowledge and understanding of native carnivorous plants of South Africa, but he also made a significant contribution to the knowledge of their cultivation. We all had the privilege of meeting Eric during travels to South Africa and this is a brief summary of Eric Green, and some examples of how he helped us, and others in the study of South African carnivorous plants.

Eric Green

Eric lived in Cape Town; and for most of the time that we knew him he was in Southfield, a suburb of Cape Town about 20 km SSE of the city center; and about 10 km east of Table Mountain. In the late 1990's he lived with his daughter, Kim, her husband, Shane, and his grandson Brandon. Eric's son, Shane, also lived in Cape Town. In the 1980's, Eric worked as an illustrator/layout designer in a printing press company (where he also created the sales lists and cultivation guidelines which he sent with his private carnivorous plant sales). Later he had his own business "Green Irrigation", in which he installed and maintained irrigation systems in gardens and buildings in Cape Town.

Eric developed a passion for carnivorous plants in a region rich in indigenous species, especially of the genus *Drosera*. Maybe because of the scarcity of local enthusiasts, Eric established a wide network of communication and trade with numerous CP hobbyists around the world. During this time he built up an impressive private collection of plants, and he was a very skilled grower, not only of native South African species, but of all genera of carnivorous plants. In the 1980's, he had a shade house with many large and thriving *Nepenthes* and *Heliamphora*. In order to provide his pitcher plants with suitable food, Eric raised cockroaches in his garage – to the shock of his wife. By the late 1990's Eric's CP collection took up his entire backyard. Thanks to Cape Town's pleasant climate with mild, humid, and frost-free winters, as well as warm, dry, and sunny summers, Eric was able to build up a large and diverse plant collection.

In 1997 most of Eric's backyard consisted of pots of *Sarracenia* species and hybrids, pygmy *Drosera*, South African CPs, *Byblis gigantea*, and tuberous Australian sundews, all sitting on low benches that were protected from the elements by a partial cover of shade cloth. The backyard was enclosed on three sides by tall concrete walls and near one of these were two large pots; one for *Drosophyllum lusitanicum* and the other for *Roridula dentata* and *R. gorgonias*. Eric had constructed three lean-to greenhouses on two of the boundary walls in which he grew Mexican *Pinguicula*, tropical *Drosera*, *Nepenthes* species and hybrids, *Heliamphora* species (mature and in flower!) and hybrids, *Cephalotus follicularis*, and tropical *Utricularia*. Eric also used the flat concrete roof of his garage in front of the house to grow most of his Venus flytraps, which also had a commanding view of Table Mountain. Amongst his collection was a very large 17-year-old *Nepenthes rajah* plant

Eric was surprised that such plants were rare in cultivation at the time, given the "ease" at which he grew his plant.

Eric propagated his plants and traded them with other enthusiasts around the world. In the 1990's he was particularly fond of *Pinguicula* and he often sent seed to colleagues with tissue culture labs who were able to produce mature plants quickly; many of these are still in cultivation; such as an attractive form of *Pinguicula moranensis* he informally called "Fraser Beaut" after his friend Fraser Lamond. Eric's generosity and kindness were obvious to all CPers who interacted with him, whether personally or through seed trades. His willingness to send seed of rare South African CPs was of course gobbled up by many enthusiasts who helped establish many of those species to cultivation thanks to Eric.

For numerous decades, Eric explored the Cape area and amassed a great understanding of where the local carnivorous plants grew. Such places included Table Mountain and Silvermine Nature Reserve, where, among other species, the showy *Drosera cuneifolia*, *D. hilaris*, and *D. ramentacea* grow; the Fernkloof Nature Reserve near the town of Hermanus (Front Cover), where *Roridula gorgonias*, *D. glabripes*, and *D. slackii* can be found; Bainskloof (Fig. 1), for *D. regia*; and Gifberg and Cederberg where *D. alba* forms stunning carpets of tightly packed blood red rosettes in thin, seasonally sodden soils. Eric also knew of different locations to see plants in the diverse and beautifully flowered *D. cistiflora* and *D. pauciflora* complexes, such as at Caledon, Darling, and Malmesbury (Fig. 2). He would often travel to these places in his motorcycle, and was keen to take visiting enthusiasts from overseas there too, or direct them to these places. Eric undertook several of his fieldtrips with his friend Günter Eitz.

During these field trips, Eric (and Günter) also came upon sundews which he could not identify, and which he proposed to be new to science, and later often were described by botanists as new species, among them *Drosera slackii*, *D. rubrifolia*, *D. coccipetala*, *D. ericgreenii*, and the natural hybrid *D.* × *corinthiaca*. Especially, Eric discovered many different location forms and taxa from the winter-growing, summer-dormant *D. cistiflora* and *D. pauciflora* complexes – some of which were described later by Paul Debbert as *D. variegata* (also known by the informal name *D. cistiflora* "Eitz"), *D. liniflora*, *D. rubripetala*, and *D. atrostyla*. Unfortunately, most of these botanical descriptions do not mention the original discoverer of the plant.

Memories of Eric Green

Robert Gibson

I had the great fortune of meeting up with Eric in 1997, 1998, and 2006. On my first trip I did not know Eric well and yet he welcomed me enthusiastically at Cape Town and generously showed me around many of the local carnivorous plant sites. One of the most memorable trips was to Gifberg and Cederberg, about 250 km north of Cape Town to see *Roridula dentata*, red-leaved *Drosera capensis*, and different forms of *D. cistiflora*. We unfortunately timed our visit in late July 1997 to one of the rare wet days in the region. The chilly air and rain did not dampen our spirits to see these amazing carnivorous plants in the wild, in a beautiful setting, but we were soaked to the bone after walking around in wet fynbos and from a slow and cold ride on the motorcycle back to Cape Town. Eric stayed in the lee of a south-bound truck for some respite from nippy headwinds. Despite this we returned to Cape Town sodden and cold but still buzzing from the plants we had seen that day.

Fernando Rivadavia

I met Eric Green on two trips, in 1997 and in 2006. Unfortunately, soon after arriving in Johannesburg in 1997, I was robbed of all my money, passport, camera, GPS, etc. Eric took me under his

Figure 1: Eric Green in the field at a *Drosera regia* site near Bainskloof in August 2003. Photo by Aric Bendorf.

wing, housing me for two weeks, feeding me, and even paying for all my expenses for the first few days until I could get a new credit card. As a result, I ended up wasting too much time between banks and consulates on that trip, but Eric did his best to save my vacation by taking me to numerous CP habitats. He even lent me his old camera for my two weeks in Cape Town as well as for the following four weeks that I travelled around the rest of South Africa and neighboring Zimbabwe.

Those two weeks with Eric in 1997 was definitely an odd time for me: I was of course very shaken by the whole robbery ordeal, but at the same time highly excited with all the amazing CPs I was exposed to. It was only over the course of the following months and years that it slowly sunk in and I came to appreciate all that Eric and his family had done for me while I was in Cape Town.

Eric personally took me to see several breathtaking CP locations, mostly on the back of his motorbike (Rivadavia 2000), which was of course fantastic. However I also remember tediously long hours on the back of that bike, feeling miserably cold and wet due to winter mists and rains, wondering how much longer my nearly frostbitten fingers would be able to keep clasping Eric's waist. We sped between CP sites as I held on for dear life, sometimes peeking over Eric's shoulder to see the speedometer reaching 160 and even 170 km/h, the whole time hoping that no trucks would come speeding around a corner on the narrow mountain roads, and praying for no guinea fowl or baboons to suddenly cross the road in front of us.

Eric had to work during the last few days of my stay in Cape Town, so he drew some magnificent maps of CP sites, all from memory. Thanks to the level of detail, I was astonished that I was able to find each and every spot on his hand-drawn maps! The only (very frustrating) exception was *D. regia* which I walked past several times, looking for an open habitat similar to what I had seen in

Figure 2: Eric (on right) with Andreas Fleischmann (center) and Fernando Rivadavia (left) at one of the few remaining sites of the purple-flowered form of *Drosera cistiflora* near Malmesbury, September 2006. Photo by F. Rivadavia.

Thomas Carow's pictures. Eric later told me *D. regia* actually grew among thick grasses and laughed at how much time Thomas had spent carefully clipping away the grasses so he could take those beautiful shots.

During my second trip in 2006, I mostly saw more of the same species and better explored habitats previously visited. But I did visit several new spots with a few more species, finally saw *D. regia*, and even discovered a new species of *Utricularia*. Yet the highlight for me was the rare dark-purple flowered *D. cistiflora* in full bloom. We only found this on our last day, thanks to a picture in a botanical book bought a few days earlier, which led us to the small town of Kalbaskraal. We happened to stop by a field that had many pretty wild flowers and decided to ask the farm owner if we could go take some pictures. To our huge surprise, the farmer not only knew about the dark-purple flowered *D. cistiflora*, but the picture in the book had been taken on his property, and he would be delighted to take us to the very spot – actually, two spots!

Thus, through a series of enormous coincidences we wrapped up our 2006 trip with two stunning populations littered with dozens of wide open dark-purple flowers of this amazing *D. cistiflora* form, which none of us had ever seen before. We were also very lucky that we were there early on a beautiful sunny day, since we'd missed seeing open flowers at other *D. cistiflora* and *D. pauciflora* populations due to overcast weather or because we arrived too late in the day.

It makes me very happy that of all the days Eric could have joined us in the field, he had by chance come on our last day to share the spectacular discovery of the rare dark-purple flowered *D. cistiflora*. As we admired what to me is the most extraordinary sundew in the world, I was able

to thank Eric for all that he'd done for me on those two trips to South Africa, while literally on my hands and knees.

It's probably very fitting that this is also my last memory of Eric Green: both of us sitting on the ground, among those beautiful, dark purple *D. cistiflora* blooms. A memory to last me a lifetime!

Andreas Fleischmann

During my South African trip in 2006, which at the same time was Fernando's second and Robert's third trip, we met with Eric twice for dinner and were able to drag him away from his work schedule to be with us in the field on our last day. Eric drew detailed maps, including every tiny dirt road and track, enabling us to quickly find almost everything we wanted, including even sites which Fernando and Robert had already seen nine years earlier, but failed to locate again from memory.

Thanks to Eric's location data and useful hints, we were able to see 23 taxa of carnivorous plants in just two weeks time – that's almost the entirety of South African CP flora! Eric was very happy that he was able to take a few hours off work to join us during two field trips; and for me it was a memorable experience to see him botanizing CP habitats and talk about the plants we encountered; re-discovering plants that he had seen many times before did not diminish his passion when he spotted the first specimens at a certain location. These spectacular sights, together with Eric's kindness, knowledge and enthusiasm will always be treasured.

Out of the many interesting stories regarding CP discoveries and past trips, which Eric glowingly told us during dinner, I remember a few nice anecdotes: Eric told us about Fernkloof Nature Reserve, a CP hotspot near the town of Hermanus, which he visited many times. Eric was smoking cigarettes while ascending Fernkloof valley, when he first met a local park ranger. They went for a walk together, and the ranger first was quite reserved, and Eric told us that he had the feeling that the ranger did not seem to like him much – because he noticed that Eric kept smoking cigarettes in the field – walking in dry, flammable fynbos vegetation in a protected area. The ranger was apparently afraid that Eric would throw away the cigarette stubs in the field, but then Eric smiled, and showed him the content of the pockets of his trousers. Eric told us that he always put the stubs in his pockets, and that on that day, they were full of cigarette stubs (Eric called them by the Africaans word "stompies"). Eric emptied his pocket into his hand, and showed it to the ranger. The surprised park ranger laughed, and became friends with Eric – and Eric told him a lot of interesting facts about the local CPs, of course.

Another story is that of Eric's discovery of the first South African "tuberous sundew". In the past, he collected plants to grow in his greenhouse, but also to share with friend CP growers all over the world. Once, he and Günter Eitz went to Gifberg highlands, to a nice location of the winter-growing *Drosera alba*, and dug with a shovel in the summer-hardened dried soil. While sieving the soil for dormancy organs of *D. alba*, he noticed some small, globose tubers. He was amazed, as *D. alba* was the only plant growing at this spot in the rainy season, according to his memory. Therefore, the tubers could only have belonged to the *Drosera*. He sent the tubers to CP growers, very excited that he had discovered the first tuberous African sundew. Half a year later, his friends reported that a nice species of *Oxalis* was growing in their pots – but no *D. alba*. And thus the myth of tuberous *Drosera* in Africa was very short lived. And indeed, we too, during our field trip in 2006 observed this nice pink-flowered *Oxalis* species growing sympatrically with *D. alba* populations on Gifberg.

Eric told us many more interesting stories about his plant discoveries. I was amazed by his botanical knowledge, his enthusiasm, kindness, and modesty. Eric, thank you again for your kind hospitality when Fernando, Robert, Kirk, Stew, and I visited South Africa in 2006; for all of the inspiring discussion on CPs, but especially for botanising and exploring the Cape area, for sharing

your experiences and discoveries with the CP community, and for helping to introduce so many of those South African beauties in cultivation! Without your efforts, the CP world would not be as rich, we would not know of so many beautiful South African sundews!

Christian Dietz

The name Eric Green has been long known to me for his extensive field work and the discovery of many South African plants. In preparation for my second trip (together with Dr. Claus-Jürgen Lenz and Tim Beier) through South Africa in September 2012, I managed to contact him and after exchanging emails we decided to meet in Cape Town.

Eric gave us a warm welcome at his house in Kuilsrivier. He was really interested to hear about what we had already seen and what we still wanted to see. His deep love for carnivorous plants was obvious.

He had an incredible memory for places. One plant we had not been able to find in 2009 was *Drosera ramentacea*. Eric was able to describe in all details off the top of his head where this plant grows. His description was so detailed, that he could even describe the shape of a nearby rock formation. Without his help, we most likely would never have found them!

We asked Eric if he could show us a location on a farm close to Caledon that he discovered years ago. Eric kindly agreed and a few moments later we were on the road and he was teaching me how to drive correctly on South African highways, especially how to overtake other cars. In South Africa, slower cars often offer the possibility to be easily overtaken by faster ones. As a "thanks", the faster car should flash its hazard lights 2-3 times after overtaking the slower car, who will then politely flash his front lights in return. According to Eric not following these rules would be ignorant and rude to the kind (but slow) driver. We all had lots of fun for the rest of the drive discussing this cultural quirk, as Eric continuously commented on every single car we overtook.

We finally arrived at the location near Caledon, where we saw *Drosera coccipetala*, *D. zeyheri*, and *D. cistiflora*. Sadly the *D. coccipetala* and *D. zeyheri* (dark pink and deep red respectively) had already spent flowers! Even so, it was well worth the visit for the privilege to be taken there by the actual person who discovered those rare plants.

We stayed at the Caledon site about two hours before we drove back to Eric's house. We gave him one of our books (Dietz *et al.* 2010), which we produced after our first tour in 2009, as a small thank you. The first thing he looked up was the pictures of the sundew named after him, *D. ericgreenii*. He told us how surprised and happy he was when he heard that a plant had been named after him. He still couldn't believe it.

Eric was really interested to know what we have seen during our trips in South Africa, so we promised to show him pictures of everything as soon as we got home in October. Sadly I never got in contact with him again. The bad news that he had passed away was sent to me by his son's girlfriend, Elmarie, in March.

Thanks for everything, Eric! It was a pleasure to meet you and to be out with you a day. This day will stay in our memories for a long time! Thanks!

Eric's Legacy

Eric helped spread a wealth of information about the carnivorous flora of the Cape Town region at a time when very little was known, allowing many CP enthusiasts today around the world to grow plants that were previously not in cultivation. The knowledge and plants shared have also resulted in the publication of numerous new species, including *D.* × *corinthiaca* (Gibson & Green 1999) and *D.*

ericgreenii (Fleischmann *et al*. 2008). Eric's enthusiasm for carnivorous plants was contagious, and thanks to his generosity many of the plants he shared live on in plant collections around the globe.

Sadly Eric passed away on Friday 15 March 2013. He is survived by a son, daughter and at least one grandchild. He will be sadly missed by many carnivorous plant enthusiasts around the world. Farewell Eric. His spirit will live on in the plants he discovered.

Acknowledgements: Thank you Eric, and your family, for making us feel welcome and sharing your immense generosity, passion, and knowledge with us and with CPers around the world. We thank Aric Bendorf, Günther Eitz, Frank Wolpert, and Dr. Claus-Jürgen Lenz for providing additional details about Eric and also sharing some of their memories with us as we prepared this paper.

References

Dietz, C., Lenz, C.-J., Jäger, A., and Paul, C. 2010. Carnivorous Plants of the Western Cape South Africa 2009. e.kurz + co, Stuttgart.

Fleischmann, A., Gibson, R, and Rivadavia, F. 2008. *Drosera ericgreenii*, a new species from the fynbos of South Africa. Bothalia 38: 141-144.

Gibson, R., and Green, E. 1999. *Drosera* × *corinthiaca* (Droseraceae), a newly recognized natural hybrid from the Cape Province, South Africa. Carniv. Pl. Newslett. 28: 81-84

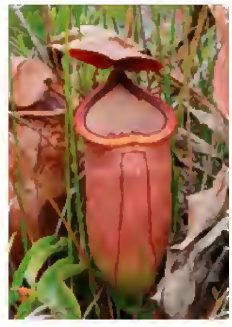
Rivadavia, F. 2000. Endless carnivorous plants in Cape Town, South Africa. Carniv. Pl. Newslett. 29: 42-45.

ICPS

10th International Carnivorous Plant Conference
18-20th JULY 2014
CAIRNS · AUSTRALIA

ANNOUNCEMENT:

10th ICPS Conference
18–20 July 2014
Cairns, Australia



The 2014 ICPS Conference is presented by the three Australian CP Societies: The Australian Carnivorous Plant Society, The Victorian Carnivorous Plant Society, and The Australasian Carnivorous Plant Society.

The conference will be hosted by The Cairns Botanic Gardens, which houses an impressive collection of tropical CPs.

This 3-day event will cater for the scientific/academic community, hobbyists, and conservationists alike with high quality contemporary speakers and a range of public events.

Two unique post-conference field trips have been organised to capture the diversity of tropical Australian CPs:

- Monday 21 July 2014, a full-day trip to Mount Bartle Frere to see three different locations for *Drosera schizandra*.
- Tuesday 22 – Saturday 26 July 2014, a rare opportunity to visit the very tip of Cape York to see *Nepenthes*, Tropical *Utricularia*, *Drosera*, and *Byblis*.

To express an interest in attending and to receive a pack, please email:

ICPS2014@captiveexotics.com.

Follow us on Facebook: www.facebook.com/ICPSconference2014.

Drosera ericgreenii – Eric Green's sundew

Andreas Fleischmann • Landsberg • Germany • fleischmann@lrz.uni-muenchen.de

Keywords: ecology, cultivation, *Drosera ericgreenii*

Drosera ericgreenii is a perennial sundew species from the Western Cape of South Africa, which was first discovered by Eric Green near the town of Franschhoek in Stellenbosch municipality, and which was formally described in 2008 (Fleischmann *et al.* 2008). The plant forms short stems with age, usually not exceeding 10 cm in height, which bear obovate to narrowly oblong leaves on short internodes. The leaves range in color from dull green to yellowish green (in plants growing in full sun); the entire petiole and lower surface of the lamina is covered with patent, long white hairs, which gives the entire plant a hirsute appearance (Fig. 1a, b). The triangular papery stipules are white or reddish as long as the leaves are active and green, and dry brownish as the leaves desiccate. The flower scapes are arcuate from the base, covered with long white, patent hairs in the lower part, and deep red in color (hence contrasting well with the green leaves; Fig. 1a, b). The upper part of the scape, the pedicels and the calyx are covered with small, red glandular hairs. The pink flowers are approximately 2 cm in diameter and last for one day only; the petals are cuneate, the 3 styles are each divided to the base; the shape of the stigmatic tips (a useful diagnostic character in South African *Drosera* species) are lobed or divided (Fig. 1c). The seed is narrowly fusiform in shape, and produced in large numbers.

Drosera ericgreenii is somewhat reminiscent of the related *D. hilaris*, from which it differs in having membranous stipules present at the base of its leaves (in *D. hilaris*, the stipules are reduced to small, inconspicuous setae, and thus are barely visible), by its much shorter stems, inflorescence scapes that are arcuately ascending at the base (the scapes are emerging straight upwards in *D. hilaris*), and by having long, non-mucilaginous unifacial glands ("snap tentacles") at the apical margin of the leaves (no such glands present on the lamina of mature leaves in *D. hilaris*). Moreover, the flower structure, namely the shape of the stigmatic tips of the styles, also differs from *D. hilaris*. The plant has previously been referred to by the informal names "*Drosera* sp. stemless hilaris" or "*D.* sp. Franschhoek" (Miyamoto 2002).

Habitat

Drosera ericgreenii occurs in a very restricted geographical range, confined to mountain slopes near the town of Franschhoek in Western Cape Province, South Africa. Here it grows on damp sandy acidic soils in xerophytic *fynbos* vegetation (a typical vegetation type of the Cape floral area, it is a drought and fire adapted ericoid scrubland; the name "*fynbos*" is derived from Afrikaans language and means "fine bush", referring to the usually small, needle-like leaves of many species growing there). Usually the plants grow solely or in small clusters in the partial shade of small rocks or beneath shrubs (Fig. 1a). There the perennial *D. ericgreenii* is often found close to the summer dormant *D. cistiflora*. While the latter always dies back above ground in summer, surviving the dry season by its long, fleshy roots, *D. ericgreenii* will simply slow its growth during the hottest months, producing smaller leaves after flowering, and may eventually even die back to a resting, apical bud (a strategy likewise observed in the stem-forming species, *D. hilaris*, *D. ramentacea*, and *D. glabripes*).

Cultivation

Unfortunately, the beautiful *D. ericgreenii* is far from being an easy, weedy species in cultivation – certainly it is not a beginner's plant to grow. It is a South African montane species of damp sandy soils (but not a bog plant!), and therefore a bit more demanding in cultivation, especially in terms of temperature and watering. Like several other mountain sundews from the Cape (*D. glabripes*, *D. hilaris*, *D. ramentacea*, *D. esterhuyseniae*, *D. cuneifolia*) it prefers cool temperatures, especially of the soil. Moreover, it has an extensive root system consisting of long tap roots, which can reach up to at least 50 cm in length, and which are adapted to grow into deeper soil naturally, in order to reach moisture. If the roots are exposed to hot temperatures for too long, and especially if the plant is kept in soaking wet soil – both conditions that are likely to occur if the plants are kept in tray system permanently, and if planted in shallow pots – the root system is likely to be damaged and will rot easily. I grow *D. ericgreenii* and the other five above-mentioned South African *Drosera* species in very tall plastic pots of *ca.* 20 cm depth and *ca.* 15 cm diameter (2-3 liter containers). By using a very open soil mix consisting of peat, coarse-grained quartzitic sand, and perlite (in about equal parts), I try to provide enough aeration for the roots. I also maintain the soil mix only moist, not soaking wet. The deep pots also allow me to keep these plants in a tray system at the greenhouse, without being permanently wet like the bog species *D. capensis* or *D. aliciae*. I let the trays dry up completely before watering them again, especially during summer, when the plants slow their growth and reduce the size and number of leaves. Good shading and air movement both seem to be important, too, especially during the hot summer months. Providing good growing conditions, *D. ericgreenii* can be persistent and long-living in cultivation, flowering each year in early spring. The flowers need to be hand-pollinated in order to set seed. Although they can be selfed, fertile seed set is higher if two different individuals are cross-pollinated. *Drosera ericgreenii* can be propagated vegetatively by root cuttings, however it does not reproduce from leaf cuttings (likewise in the other five above-mentioned, dry-loving *Drosera* species, leaf cuttings do not work either). Hopefully this nice species will enter more *Drosera* collections worldwide soon!

Etymology

Drosera ericgreenii was named in honor of the South African carnivorous plant expert Eric Green, who discovered countless localities of carnivorous plants in the Cape area, and who originally discovered several new species of *Drosera* (including *D. slackii*, *D. rubrifolia*, *D. coccipetala*, *D. cistiflora* "Eitz", *D. afra*, and others). Eric also can be traced back as the original seed source of almost all South African *Drosera* which entered carnivorous plant collections worldwide in the past decades from the late 1970's on.

When Robert Gibson, Fernando Rivadavia, Stewart McPherson, Kirk "Füzzy" Hirsch, and I met Eric on our trip to Cape Town, we were all deeply impressed by his profound knowledge of South African plants, by his photographic memory of carnivorous plant locations, but especially will remember his hospitality and cordiality. Eric kindly and enthusiastically shared his location data with us, including how to find the "stemless *D. hilaris*" site, which we visited in 2006 to study the plant we only knew from photographs and herbarium specimens in its natural habitat, allowing the formal description to be made in 2008.

We did not have to think long when it came to finding an appropriate name for this new species – it was clear to all of us that finally a plant name should be dedicated to Eric Green.

However, we did not tell Eric about this plan, keeping it a secret while preparing the plant de-

Figure 1: a) A group of *Drosera ericgreenii* in habitat near Franschhoek, South Africa. b) *Drosera ericgreenii* with emerging inflorescences, Franschhoek, South Africa. Note the very hairy scape, which is arcuate at the base. In the related *D. hilaris*, the scape is growing upright from the center of the plant. c) Flower of *Drosera ericgreenii* (cultivated specimen). All photos by A. Fleischmann.

scription. Thus Eric was very happily surprised when I sent him the printed botanical description right after it was published. He replied with a very touching letter:

"I am Honoured, more than honoured, and absolutely amazed that being fascinated by the most beautiful plant species in the world for a 'few' years in ones lifetime could give one the satisfaction of achieving something that makes one feel so good.

I realise many names must of been bantered about, Why me????, when friends mentioned naming a plant in my honour in the past we would always laugh and say this or that beautiful reddish plant will one day be named greenii, not in my wildest dreams did I ever believe a plant would be burdened with my name, what an amazing honour.

Gentlemen Thank You."

Apparently he was deeply moved by this, because a few days later, he sent another short email to me:

"*It is an amazing gift, thank You, I still, after 3 days find it difficult to believe what an honour I have received.*

It will be great to see You in Cape Town once again in the near future.

ALL THE BEST Eric".

Unfortunately, I was not able to make it back to Cape Town in the past years to meet Eric again, but we kept some correspondence by mail. Eric later told me that he took a copy of the *D. ericgreenii* article everywhere with him in the car, and proudly showed it to friends and family.

Thank you Eric for your contributions to the knowledge and cultivation of South African carnivorous plants!

References:

Fleischmann, A., Gibson, R., and Rivadavia, F. 2008. *Drosera ericgreenii* (Droseraceae), a new species from the fynbos of South Africa. Bothalia 38: 141-144.

Miyamoto, M. 2002. *Drosera* of South Africa. The detail view of an undecided kind, and comparison of a definite kind [*sic!*]. Journal of the Japanese Carnivorous Plant Society 8: 15-18.

petflytrap

THE ORIGINAL VENUS FLYTRAP

- Mail order and Internet U.S. sales
- *Dionaea, Sarracenia, Nepenthes, Drosera, Pinguicula*, books, supplies, and **much** more
- We stock **multiple sizes** of most plants
- Terrarium kits with **live plants** (no seeds)
- Rare nursery-grown, imported lowland/intermediate *Nepenthes*
- Most plants shipped potted and **ready to grow**!

www.petflytrap.com
orders@petflytrap.com
281-433-3286

Bob Hanrahan

Phill Mann • Western Australia • Australia

The sad news that Bob Hanrahan had lost his long battle with cancer came recently, bringing back a flood of fond memories. Bob was a tall man in both stature and knowledge, with a wonderful easy going personality. He had been involved with CP's before the beginning of the ICPS.

I first traded letters and views with Bob from the early 1970's where we developed a great friendship, then through World Insectivorous Plants. I visited Bob in 1986 and was so impressed with the hospitality of Bob and Cathy. He took us camping down at his "bush block" where we helped plant out a few hundred VFT's, visiting all the best sites of *Sarracenia* along the way.

Bob and Cathy stayed with us here in Australia in 2007 where I had the pleasure of showing him some of the best of our scenery.

Bob's knowledge played an important part understanding the growing of *Sarracenia* both in the U.S. and in Australia.

Bob will be really missed, not only by me and the vast number of friends he had made along the way, but also with his vast knowledge of the CP's and their growing. Our thoughts are with Cathy and the family.

Bob and Cathy Hanrahan in a Western Australia suburb in July 2007 where the tame kangaroos take no notice of the constant flow of tourists.

The Savage Garden: Bob Hanrahan

Peter D'Amato • California Carnivores • 2833 Old Gravenstein Hwy • Sebastopol, CA 95472 • USA • califcarn@aol.com

The first time I heard about Bob Hanrahan and World Insectivorous Plants (WIP) was in the spring of 1980. I had just moved from Nob Hill to the Castro Street neighborhood in San Francisco. Around the corner from my Victorian apartment was a shop called Tommy's Plants. They had an interior store and a courtyard out back for outdoor plants.

It was in the courtyard that I experienced a shock that eventually led to a major detour of my entire life. In a large hanging pot was a huge plant I recognized as a sundew, but I had never seen anything like it. It was the giant form of *Drosera binata* var. *dichotoma*.

I had a very nice collection of carnivorous plants back in the late 1960's and early 1970's during my junior high and high school years. On my nursery's web site www.californiacarnivores.com, under About Us, there's an old black and white photo of me at about age 14 that appeared in a local New Jersey newspaper. My lush old-fashioned terrarium was crowded with Venus flytraps, American pitcher plants, and sundews – all were domestic North American species mostly purchased from Northrop's Insectivorous Botanical Gardens and the Carolina Biological Supply Company, both in North Carolina, and Peter Paul's nursery in upper New York state. In those days nearly all the plants sold by these vendors were removed from wild populations.

As I stared at this giant forked-leaved sundew in awe that spring of 1980, I thought of the lone surviving carnivorous plant back at my apartment on my tiny deck. It was a lonely *Sarracenia purpurea* subsp. *purpurea*, the only plant I took with me when I left New Jersey for the University of Miami. I had given my collection to a friend and you can guess what happened to *them.* But I took my purple pitcher plant with me for nostalgic reasons, nearly killing it in hot Miami until I put it in the refrigerator for its winter dormancy. The plant followed me when I relocated to San Francisco. I knew that moment in Tommy's Plants my solitary survivor would soon have little friends.

Bill Barnett, an employee at Tommy's (now at Sloat Gardens), was thrilled at my excitement, for most customers knew nothing about carnivorous plants. He showed me plants he had for sale: Venus flytraps, sundews like *Drosera aliciae*, *capensis*, *binata*, and × *watari,* and some *Sarracenia* as well. I bought them all! It was an amazing day of revelation for me. Bill told me a carnivorous plant society had been started a few years before and its co-founder, Joe Mazrimas, lived in the Bay Area. He lent me copies of CPN, and also Adrian Slack's "Carnivorous Plants", published the year before, and Don Schnell's "Carnivorous Plants of the United States and Canada", published in 1976.

"But where did you get *these* plants from?" I asked Bill, as he rang up my purchases. He pointed to the literature he was lending me. "You've got the catalogue right there. World Insectivorous Plants, owned by a guy named Bob Hanrahan. And he *propagates* all of the plants he sells. Nothing is taken out of the wild!"

Bob Hanrahan was born in Los Angeles in 1947. He attended Long Beach City College and then Brigham Young University in Utah, where he was on the track team and an All American for the long jump in 1967. He received his BS degree from Long Beach State College and worked his whole life as an engineer for Lockheed Martin. He married his wife Cathy in 1969, an always gracious woman

Bob Hanrahan (center) with Damon Collingsworth (left) and Peter D'Amato (right) at California Carnivores in 2010.

I've met several times. They had three kids and several grandkids, and were active in The Church of Jesus Christ of Latter-day Saints.

Bob started WIP in 1978. His business partner was Clark Barton, with whom I am still friends. (I got Bob, Cathy, and Clark together just a few years ago. Bob was thrilled I knew him and they had lunch in Reno where Clark retired when Bob and Cathy last visited me.) Clark helped finance WIP's large automated greenhouse in Arroyo Grande in Southern California. They began to propagate carnivorous plants (CP) at a furious rate and sell them bare-root through mail order. The first article Bob wrote for CPN was about purifying water through reverse-osmosis, a new invention at the time. He wrote only a few articles for CPN, which is a shame, since he was a very good writer.

Due to his job, the Hanrahans moved to Florida for a while and Bob continued WIP. Jim Miller, still active in the hobby, was an employee. Later Bob had to relocate again, this time near Atlanta, Georgia.

I ordered my first catalogue directly from WIP on December 27, 1981, and received my first plants that February. WIP's plants were always high quality and I was thrilled with them. I began to grow many of them in a "potted-greenhouse-style tank" so I could remove temperate plants for winter. I also grew many on my tiny deck and an outdoor window box. I was a design engineer for Levi Strauss at the time and soon my sunny office windowsill facing San Francisco Bay was crowded with CP, much to the amusement of co-workers. All my plants came from WIP.

In February, 1983, I moved north to Sonoma County. There were several reasons but the main one was I needed room for all of the plants I was buying from Bob, and also trading with growers from around the world.

In 1988, Bob announced in a CPN article that he was winding down the retail end of WIP. He was going to produce fewer varieties and sell primarily wholesale. One thing that frustrated him was that most CP growers at the time wanted to buy plants "cheap" and Bob admitted with honest bitterness that due to the time and expense of propagating so many plants and running a mail-order nursery, the plants he was selling should cost up to ten times more than what he was getting for them.

In early 1989, I had been working at a resort on the Russian River for six years. The resort was sold, and although the new owners wanted me to stay on as a manager, all I was thinking about was growing CP and selling them wholesale to local nurseries. In one of those psychic, synchronistic events, Bob Hanrahan called me. "How would you like to be the wholesale distributor for my Venus flytraps in Northern California?" I enthusiastically agreed.

In April of 1989, I was asked by a large garden show in San Francisco to co-ordinate a display for the newly founded Bay Area Carnivorous Plant Society that I helped co-found. We had less than a dozen members and no one had the time. I already had a business license for California Carnivores to sell Bob's Venus flytraps and thought: If I did a display on my own, maybe I could pick up a dozen or so interested nurseries and wholesale Bob's plants to them! Friends helped me. At the three-day show, we gave away 3,500 cards – and people weren't interested in just flytraps! I decided I had to go retail and do something no one had done before: open a CP nursery to the public with regular business hours.

I struggled that year selling Bob's flytraps but not making much money. That autumn I found a dilapidated large greenhouse for rent at a winery, and I called Bob. "Help! I have to fill my nursery up with plants for sale by spring!" Bob laughed. "Just tell me what you want!" he enthusiastically replied.

California Carnivores opened to the public in the spring of 1990. Although I had a number of plants to sell that I had propagated myself, 50% of our stock came from Bob. The nursery appeared on TV shows, magazines, and numerous newspapers including the New York Times. This would not have happened without Bob Hanrahan.

I didn't meet Bob in person until the first ICPS conference in Atlanta in 1997. He was tall, handsome, and always exuberant, like a kid who just found out he would be taking a trip to Mars! At his house, then in Marietta, a bunch of us "old timers" marveled at his collection – not just his plants but books, articles, old CP catalogues from days gone by. (Bob had a nostalgic streak. He once sent me an Internet link to old TV commercials from the 1950's and 60's that made me laugh my head off and he wrote "Those were the days!")

It was after the conference that many of us visited "the plantation", a multi-acre parcel of land Bob had purchased with an extraordinary population of native pitcher plants and sundews in southern Alabama. This was where I raised such a fuss over one incredible *Sarracenia* hybrid. He gave me and Leo Song the honor of removing a piece of rhizome, which he turned over to the Atlanta Botanical Gardens in an attempt to have it tissue cultured. (Alas, the attempt failed.) I later nominated the plant as *S.* 'Adrian Slack' with Bob's blessing, honoring the legendary British horticulturalist in the CPN's issue commemorating him.

I've been to the plantation a couple of times since. On one trip, with Bob limping due to hip replacement surgery, we took a six-hour tour until I couldn't walk anymore. He, however, was practically jumping up and down wanting to show me yet another section of the property. His wife Cathy came to my rescue with iced sweet tea from "the shack", a tiny, comfortable cottage he had built there.

While Bob kept the property primarily as a preserve, he also had a small area where he grew and propagated introduced plants such as Venus flytraps. He would harvest seed from the property to sell to the Dune Craft company that marketed small plastic terrariums and seed of CP to children's toy and science stores.

He was rightfully boastful of his propagation prowess as well. He would phone me or send an email saying things like, "Yesterday I planted 3,788 baby *Sarracenia,* laid out 2,100 sundew leaf

cuttings, and collected three pounds of Venus flytrap seed! Oh! And I painted a neighbor's barn too!" I'm only *slightly* exaggerating.

In more recent years, Bob informed me of his health challenges. I had been writing a series of biographical essays for CPN on influential persons involved with carnivorous plants (such as F.E. Lloyd, Paul Zahl, Joe Mazrimas, and Don Schnell) and told Bob my next piece would be on him. However, in 2011 I was asked by my publisher to revise and update my book *The Savage Garden*, which took nearly a year and half to complete, and was also a few hundred pages into a botanical horror novel called *From a Crevice in Hell*.

Bob seemed to be having some improvement with his cancer through treatments such as stem cell therapy. He and Cathy were to visit California Carnivores this past spring, 2013. I told him I would interview him then. Unfortunately he had to cancel, having health setbacks, but told me he would try to come out for the nursery's annual summer party in July. I told him if he was up to it he could be our guest speaker.

But sadly, the visit never happened. Bob passed away on May 25th, leaving a legacy rich with humor, passion, and many of the plants we all grow.

CASCADE CARNIVORES
Carnivorous Plant Nursery
• Drosophyllum lusitanicum
- Yes, we ship Dewy Pine plants - live delivery guarantee
• Nepenthes
- highland species are our specialty
• Drosera, Pinguicula, Utricularia,
Byblis, Heliamphora, VFTs and more
Visit us on the web - www.cascadecarnivores.com
phone - 425.336.1420 email - support@cascadecarnivores.com

CALIFORNIA CARNIVORES
The Largest Most Famous CP Nursery in North America
Home of the largest collection of CP in the world on display Thurs. - Mon. 10 Am - 4 Pm
We ship only the highest quality plants in our deluxe pots to the entire U.S.
Owned by Peter D'Amato, author of "The Savage Garden"
707-824-0433
www.Californiacarnivores.com
Califcarn@aol.com

Memories of Bob Hanrahan

Jim Miller • jim_miller@mindspring.com

Bob Hanrahan was a man with limitless generosity and boundless energy. He could never be accused of doing anything less than on a grand scale. When he decided to start up a company that would market carnivorous plants, he created WIP (World Insectivorous Plants), the first retailer to offer CP from around the world. When he decided to grow native *Sarracenia*, *Drosera*, *Dionaea*, and *Pinguicula*, he didn't plant a backyard bog; he created a 20-acre preserve that today is one of the last places where you can actually see native CP growing together in optimum conditions – it's like stepping out of a time machine set to the 1960s, when fields of *Sarracenia* and other native CP were a common sight in and around the Gulf Coast. And if you could propagate a hundred flytraps a day, Bob wanted to figure out how to propagate a thousand in the same time frame.

I first met Bob in the mid-1970s, when WIP was located in Arroyo Grande. I started sending him seed from Gulf Coast native CPs and that earned me an invitation to visit the WIP facilities, as well as taking a drive up the California coast to Gasquet to observe *Darlingtonia* in the field. In the late 1970s, Bob's "day job" took him to Melbourne, Florida and we began making regular trips together to all the great CP sites: The Green Swamp, the Yellow River, the Mobile Bay area, the Okefenokee Swamp, and other historical "hot spots." Though Bob and I came from radically different backgrounds and had few things in common, the one thing that we never tired of was CP. I am certain we spent hundreds of days together in hot, humid bogs and cheap motels from the Carolinas through the Florida Panhandle and into Alabama and Mississippi, and we never seemed to run out of things to talk about.

I was often a guest in the Hanrahan household and got to know his wife, Cathy, and his three children. For a while, wherever Bob moved, from Sacramento to Atlanta, I was not far behind him. In some ways, for a while at least, I was closer to Bob's family than my own. For a time, I even worked for WIP, packaging orders and shipping them to many of the very people who are reading these words. I have wonderful memories of those times when Bob and I were both in our 30s and we traveled everywhere with my faithful border collie, Woofie. And though Bob was a few years older than me, I always had to struggle to keep up (and rarely could); it's as if he had some secret energy source that he could tap into.

But by the mid-1980s, it became apparent to both of us that many of the prime habitats were disappearing, which made the sites that remained even more precious, and led Bob to purchase acreage in what he liked to call L.A. – "Lower Alabama." I think that other than his family, that property, which ultimately became known as the Carnivorous Plantation, was Bob's pride and joy.

We began to lose touch with each other in the late 1980s and early '90s, when I got married and moved back to California, but when my wife and I moved back to Florida in the late 1990s, Bob and I started to reconnect. Eventually, I'd make at least one or two trips a year from Tallahassee to L.A. to marvel at the plants there. I'd recognize *flava*s from DeFuniak Springs, *alata*s from what used to be huge fields near Pascagoula, Mississippi and *rubra*s from the Yellow River. They were like old friends, and I was so happy to know that while the plants had long ago been extirpated from a certain location, Bob made it his business (and passion) to keep representative plants alive on his property.

When I learned that Bob had become ill, I believed with all my heart that if anyone could beat this thing, it would be Bob. Even after chemotherapy treatments that would have left the average person bed-ridden, Bob was out rescuing plants or making improvements to the property. And somehow he still had more energy, more get-up-and-go than me. In fact, Bob and I had planned to get together just a few weeks before I got "the call" and learned that he had passed away.

Bob had some degree of impact on almost every person with a passion for carnivorous plants. His love of CP and the Carnivorous Plantation he so carefully cultivated are his legacy, and I am sure there will be plants growing 50 or even 100 years from now that would never exist were it not for Bob Hanrahan. I surely do hope that the "better place" we are all supposed to go to one day will be hot and humid with towering afternoon thunderstorms and *Sarracenia* stretching out as far as the eye can see.

ERRATUM

The correct name for the hybrid butterwort *Pinguicula grandiflora* subsp. *rosea* × *P. vulgaris*

Jan Schlauer • jan@carnivorousplants.org

Aymeric Roccia (2013) described a new hybrid butterwort from the Alps of Isère, SE France. Unfortunately, the present author did not have a chance to review the manuscript before the article went to print, so a nomenclatural problem was overlooked. The new hybrid involves a subspecies different from the type subspecies of *Pinguicula grandiflora* (*viz.*, *P. grandiflora* subsp. *rosea*) as a parent, while the analogous hybrid of the type subspecies of *P. grandiflora* was already described earlier under the legitimate name *P.* × *scullyi* (Druce 1922). The new hybrid can thus not receive a name different from *P.* × *scullyi* at species rank as originally proposed by Roccia (*cf.* ICN, Art. H.5.2. "If the postulated or known parent taxa are of unequal rank the appropriate rank of the nothotaxon is the lowest of these ranks", McNeill *et al.* 2012). Subspecies rank is appropriate in the present case, and the formally correct name is:

Pinguicula × *scullyi* nothosubsp. *gresivaudanica* (Roccia) J. Schlauer comb. & stat. nov.

Basionym: *Pinguicula* × *gresivaudanica* Roccia, Carniv. Pl. Newslett. 42(2): 37 (2013)

References:

Druce, G.C. 1922. Secretary's Report for 1922. The Botanical Society and Exchange Club of the British Isles 6: 159.

McNeill, J., Barrie, F.R., Buck, W.R., Demoulin, V., Greuter, W., Hawksworth, D.L., Herendeen, P.S., Knapp, S., Marhold, K., Prado, J., Prud'homme van Reine, W.F., Smith, G.F., Wiersema, J.H., and Turland, N.J. 2012. International Code of Nomenclature for Algae, Fungi, and Plants (ICN, Melbourne Code). Regnum Vegetabile 154. Koeltz Scientific Books, Koenigstein, Germany.

Roccia, A. 2013. *Pinguicula* × *gresivaudanica* (Lentibulariaceae), a new butterwort hybrid from the French Alps. Carniv. Pl. Newslett. 42(2): 36-46.

A short history of an exotic carnivorous planting in New Jersey, USA

Barry A. Rice • Center for Plant Diversity • University of California • One Shields Avenue • Davis, California 95616 • USA • bamrice@ucdavis.edu
Jim Bockowski • 7168 N. Pale Moon Tr. • Tucson, Arizona 85743 • USA

Keywords: field studies: New Jersey, *Sarracenia*—conservation: non-native species.

More than thirty years ago, a few non-native carnivorous plants were introduced into a prime wetland in New Jersey. We provide a candid description of the events that followed, and the current state of affairs at this site. While it is now widely understood that such introductions of non-native plants into wildland areas are generally unwise, back then this knowledge was not so widespread. This paper is not intended to debate the merits or dangers of introducing non-native plants, nor is it intended as an exercise in laying blame. It is hoped, however, that future botanists encountering this site might find this paper illuminating and clarifying.

The Pine Barrens

For carnivorous plant enthusiasts, southern New Jersey is well known as a hotbed of carnivorous plants. This region of the USA—known as the Pine Barrens—is rich with bogs and other wetlands, and its list of native carnivorous plants excels! The *Utricularia* list is particularly rich: *Utricularia cornuta*, *U. geminiscapa*, *U. gibba*, *U. inflata*, *U. intermedia*, *U. juncea*, *U. macrorhiza*, *U. minor*, *U. olivacea*, *U. purpurea*, *U. radiata*, *U. resupinata*, *U. striata*, and *U. subulata* (Rice 2007). Of course, to complete the carnivorous plant list you must include *Sarracenia purpurea*, *Drosera filiformis*, *D. intermedia*, and *D. rotundifolia*. The *Sarracenia purpurea* plants are particularly enjoyable to those who like puzzles, since this part of the USA is in the overlap zone between the ranges of *S. purpurea* subsp. *venosa* and *S. purpurea* subsp. *purpurea*. Many times I (BAR) have encountered a pitcher plant in "the Barrens" and was unable to confidently classify it to subspecies. Such plants, exhibiting intermediate characteristics, are often referred to as "New Jersey intergrades." New Jersey is also the only state where the sterile hybrid *Drosera* × *hybrida* has been recorded as native (Brittnacher 2011).

Navigating the Barrens can be a challenge. The region is a maddening maze of intertwining, unnamed roads. Even today, what to the GPS-enabled, GoogleEarth-savvy researcher looks like an easy trip can be revealed on-the-ground as an impossible journey through flooded basins or deep pits filled with treacherous sugar sand. Even well-equipped 4WD vehicles often become mired—a powerful winch can be an invaluable tool!

The Barrens are so formidable, it is no surprise that they are famously haunted by an entity called the Jersey Devil—a monster that seems to have crawled out of the pages of a horror story by H.P. Lovecraft. But for visitors with an interest in the natural world, the Pine Barrens are beautiful, and rapidly find a place in the heart.

1978 introduction

Jim Bockowski (second author) grew up in the New York area, and visited the Pine Barrens repeatedly from 1962 to 2006. By the late 1970s he had identified one area that seemed suitable for

some plant introduction experiments. His main motivation was not scientific—rather, he needed a place to keep his plants while he was moving from one apartment to another.

The site he selected was in effect a natural impoundment. Numerous small streams and seepages led into the site, but dense growths of *Sphagnum* clogged the sole outflow. As a consequence, any detached plantlets that might result from his introductions would be prevented from leaving. This provided a degree of isolation he was looking for. The introduction was conducted in 1977, and consisted of small clumps of *Sarracenia flava*, *S. rubra*, *S. minor*, and *Dionaea*. They all survived their first winter, and on a monitoring trip Bockowski took with Phil Sheridan in August 1978, they were observed to be in good health (Sheridan 1978). Within another 2-3 years, The *Dionaea* and *S. flava* perished. For years afterwards, Bockowski visited the site regularly to remove any and all flower buds—no flowers were allowed to produce pollen because he was concerned that his introductions might hybridize with the natives.

Ten years later—1988

In 1988, I (BAR) visited the Pine Barrens. This was to be the first time I would ever see carnivorous plants in the wild, and I prepared for it carefully. Having read Phil Sheridan's 1978 trip summary to the Pine Barrens, I contacted Jim Bockowski. Jim was kind enough to give this very inexperienced enthusiast fine suggestions on places to visit—including his introduction site. At that time, access involved driving along the busy Garden State Parkway, and following an exit to a rest stop situated among the trees between the northbound and southbound lanes of traffic. The next step was

Figure 1: An image from 1988 showing the large clump of *Sarracenia rubra* and a single plant of *S. minor* (at left). Native *S. purpurea* is visible in the background. Photograph by Barry Rice.

to wait for a pause in the high-speed southbound traffic, and dart across the lanes on foot—no doubt a questionably legal maneuver. The last leg of the trip consisted of a 1-km walk through a maze of unsigned roads consisting of loose sugar sand and deep puddles that spanned the entire roadway.

The trip was very successful, and I saw the usual ensemble of New Jersey carnivorous plants—*Sarracenia*, *Drosera*, and *Utricularia*. Jim's introductions were also flourishing—a few *S. minor* plants were still there, and the *S. rubra* had grown into a large clump a few meters in diameter (Fig. 1). I noticed numerous spent flowers on the *Sarracenia rubra*. While all this was interesting to see, I was more excited by the native species that were all around.

Meanwhile, Jim had not been visiting the site as regularly as he would have liked. The site was quite difficult to reach. The situation was made even worse when his only access to the site was blocked. This accounted for the numerous intact flowers I observed. Several years after my trip, he was able to find a new access to the location and was surprised to find that the *S. rubra* clump had continued to grow, producing hundreds of seed pods. As he emailed me in 2011, "Everywhere I looked in that little bay were seedlings, plants, and hybrids with the purps [*S. purpurea*]." He even saw a specimen of *S. rubra* × *minor*. On this and subsequent trips he began removing and destroying plants at the site. However, this kind of work is very hard (on one trip, assisted by two friends, he removed more than two bushels of plants). Despite frequent eradication trips, there were still plants and hybrids at the site when he retired and moved to Arizona. His last visit to the site was in 2006.

Jim notes another problem at this site—the impact from off-road vehicle enthusiasts. Even a quick study of aerial maps (such as on GoogleEarth) reveals that the area is heavily visited by four wheel drive enthusiasts who enjoy the area for the challenges presented by the mix of sugar sand, puddles, and bogs. (A warning to would-be visitors—some of these enthusiasts do not appreciate outside visitors, and can be threatening or even overtly hostile.)

Figure 2: An image from 2010 showing the large clump of flowering *Sarracenia minor*. Photograph by Jason Ksepka.

Figure 3: An image from 2010 showing the large clump of *Sarracenia purpurea* (center-left), clumps of *Sarracenia rubra* (background-right and foreground-right), and also a few hybrid *Sarracenia*; all apparently in flower. Photograph by Jason Ksepka.

Figure 4: An image from 2010 showing a cross (or backcross) of *Sarracenia rubra* × *purpurea*. Photograph by Jason Ksepka.

A consequence of the off-road enthusiasts has been a change in the hydrology of the area. Sediments shifted by their activities, and intentional river modifications, have changed how the water filters out of the site. Now, water flows readily out of the site through small channels. Seeds from this hybridization zone—once constrained to stay in the small bay—are now free to float out to the rest of the Pine Barrens.

A 2010-2012 update

In 2010, Jason Ksepka and Dave Evans visited the site and reported to me what they saw (pers. comm.). They observed a small number of *S. rubra* clumps, a single large clump of *S. minor* (Fig. 2), and several *S. rubra* × *purpurea* hybrids (Figs. 3, 4), all of which had been flowering.

On a subsequent trip in 2012, specimens of both species and the hybrid were collected. I prepared these specimens and submitted them to the herbaria at the University of California, Davis (DAV: *Sarracenia minor*—BR120604; *Sarracenia rubra*—BR120606; *S. rubra* × *purpurea*—BR120608) and the Chrysler Herbarium at Rutgers (CHRB: *Sarracenia minor*—BR120603; *Sarracenia rubra*—BR120605; *S. rubra* × *purpurea*—BR120607).

Future botanists discovering aberrant *Sarracenia* in the Pine Barrens should be able to locate these specimens and be forewarned about the genetic contamination that has occurred.

References

Brittnacher, J. 2011. *Drosera* × *hybrida* rest in peace. Carniv. Pl. Newslett. 40: 112-121.

Rice, B.A. 2007. The Carnivorous Plant FAQ v.11.5, http://www.sarracenia.com/faq.html, accessed 8 March 2013.

Sheridan, P. 1978. New Jersey Pine Barrens. Carniv. Pl. Newslett. 7: 107-109.

Carnivorous Plant Nursery

Promoting environmental stewardship through engaging educational materials and low-cost, high-quality carnivorous plants.

CARNIVOROUS PLANT NURSERY

- Carnivorous Plants
- Bog Orchids, Bog Plants
- Live Wingless Fruitflies
- Activity Book for Carnivorous Plants
- Bugs in the Bog Board Game
- Free Monthly Drawing
- Online Shopping and Mail Order

www.carnivorousplantnursery.com

301-519-7505 | info@carnivorousplantnursery.com | 16128 Deer Lake Road, Derwood, MD 20855

Phylogeny and biogeography of the Sarraceniaceae

John Brittnacher • Ashland, Oregon • USA • john@carnivorousplants.org

Keywords: History: Sarraceniaceae evolution

The carnivorous plant family Sarraceniaceae in the order Ericales consists of three genera: *Darlingtonia*, *Heliamphora*, and *Sarracenia*. *Darlingtonia* is represented by one species that is found in northern California and western Oregon. The genus *Heliamphora* currently has 23 recognized species all of which are native to the Guiana Highlands primarily in Venezuela with some spillover across the borders into Brazil and Guyana. *Sarracenia* has 15 species and subspecies, all but one of which are located in the southeastern USA. The range of *Sarracenia purpurea* extends into the northern USA and Canada. Closely related families in the plant order Ericales include the Roridulaceae consisting of two sticky-leaved carnivorous plant species, Actinidiaceae, the Chinese gooseberry family, Cyrillaceae, which includes the common wetland plant *Cyrilla racemiflora*, and the family Clethraceae, which also has wetland plants including *Clethra alnifolia*.

The rather charismatic plants of the Sarraceniaceae have drawn attention since the mid 19th century from botanists trying to understand how they came into being, how the genera are related to each other, and how they came to have such disjunct distributions. Before the advent of DNA sequencing it was very difficult to determine their relationships. Macfarlane (1889, 1893) proposed a phylogeny of the Sarraceniaceae based on his judgment of the overlap in features of the adult pitchers and his assumption that *Nepenthes* is a member of the family (Fig. 1a). He based his phylogeny on the idea that the pitchers are produced from the fusion of two to five leaflets. Goebel (1891) strenuously objected to the leaflet idea but Macfarlane did not accept or understand Goebel's arguments (Macfarlane 1893). Macfarlane placed *Heliamphora* more ancestral to *Darlingtonia* and *Sarracenia* because of the perceived complexity and similarities in structure between *Darlingtonia* and *Sarracenia* and he believed the pitchers of *Heliamphora* are intermediate between the *Darlingtonia*/*Sarracenia* pair and *Nepenthes*. Both *Nepenthes* and *Heliamphora* have double "dorsal flaps" with those of *Nepenthes* being farther apart. Of course we know today that *Nepenthes* is in a totally different plant order and the pitchers of all four genera develop as if from one simple folded leaf (*cf.* Lloyd 1942).

Goebel (1891), Lloyd (1942), and Franck (1976) offered additional views on pitcher development and morphology. But unlike Macfarlane they were not champions for Darwinism so did not feel compelled to discuss their observations in an evolutionary context. And unlike Macfarlane they had access to more plant samples and studied the juvenile plants in much more detail. Goebel actually started *Darlingtonia* and *Sarracenia* from seed, studied the seedlings in detail, and lamented the fact he could not get any *Heliamphora* seeds. Lloyd, who studied under Goebel, did extensive field studies and saw variations in pitcher structure that are not typically seen in cultivated plants. Lloyd also confirmed and expanded on Goebel's observations of developing leaves. Except for removing *Nepenthes* from the phylogeny none of this work helped improve our understanding of the relationships between the genera.

Franck (1976) did the most important morphological work with respect to evolutionary biology. He showed that the juvenile pitchers of *Darlingtonia* are not immature versions of adult pitchers. The juvenile pitchers have significantly different developmental patterns from the adult pitchers

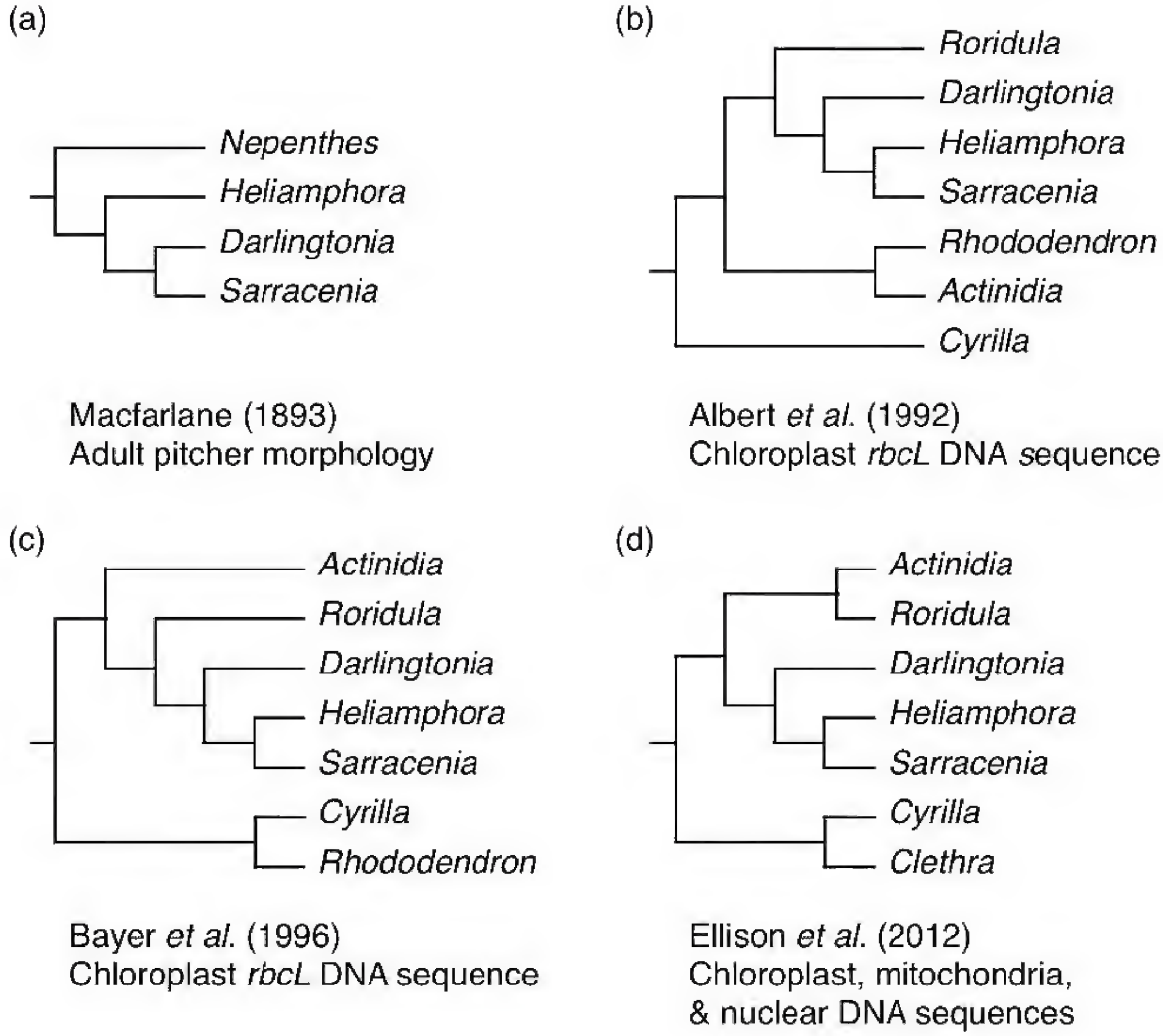


Figure 1: Phylogenies produced in studies of the Sarraceniaceae and the data on which each phylogeny was based. The length of the lines is arbitrary.

when compared to what is typically found in other plants that change leaf morphology as they grow. All the previous authors had assumed the juvenile pitchers were developmentally immature forms of the adult pitchers and thus not that interesting. I expect a study of *Heliamphora* adult and juvenile pitcher development would give similar results. However even today the juvenile pitchers of *Heliamphora* are pretty much ignored (*e.g.* McPherson *et al.* 2011) if not misunderstood. Juvenile *Heliamphora* pitchers may not provide much taxonomic value but like *Darlingtonia* juvenile pitchers are exquisitely adapted for trapping in a different way from the adult pitchers.

If the Sarraceniaceae is not related to *Nepenthes*, what is the family related to? The plant families closest to the Sarraceniaceae could not be determined from morphological details even as late as 1975. DeBuhr (1975) did a comparative study of the Sarraceniaceae in relation to other families in the Ericales to assign it to a suborder. Based on stamen morphology and number he placed the Sarraceniaceae in the suborder Theineae that contained the tea family, Theaceae, and the Actinidiaceae and not in the suborder Clethrineae with the families Clethraceae and Cyrillaceae. In retrospect the definition of Theineae was overly broad and almost a catchall suborder while the Clethrineae was too narrow based on incomplete information and the use of pollination-associated adaptations. The curious genus *Purdiaea* now placed in the Clethraceae based on DNA sequenc-

ing is from Central America, northern South America, and Cuba and matches the Sarraceniaceae in number of stamens (Anderberg & Zhang 2002) but did not fit the earlier definition of the Clethrineae. Species in the Clethraceae (as well as some in the Actinidiaceae) have poricidal anthers, another character used to define the suborder Clethrineae. Poricidal anthers fold in making a tube to protect the pollen from rain and fog. There are pores at the downward end of the anthers where the pollen falls out when the anthers are vibrated by bees. *Heliamphora* has this feature but the pore is not as fully defined as it is in typical poricidal anthers (Renner 1989) so DeBuhr did not observe it in his dried material. Taxonomists like characters like poricidal anthers because they can be seen in dried flowers. Unfortunately they are not really appropriate for use in taxonomy above species level because they are climate and pollinator adaptations that have arisen separately in many plant groups (Renner 1989).

A full understanding of the phylogenetic context of the Sarraceniaceae was not approached until a DNA sequence study done by Albert *et al.* (1992). This study used the DNA sequences of the chloroplast *rbcL* gene to place the carnivorous plant genera among 72 plant families. They used this sequence because it changes slowly and helps resolve relationships well at the genus and family level. The study showed unequivocally that *Nepenthes* is related to *Drosera*, *Dionaea*, *Drosophyllum*, and *Plumbago* while the genera in the Sarraceniaceae are related to *Roridula* as well as *Rhododendron* and *Actinidia* (Fig. 1b). The results of the study showed that gross physical characteristics like those used by Macfarlane cannot be used to determine relationships among carnivorous plant genera. There are too many cases where unrelated carnivores have superficially identical adaptations. They also showed that *Darlingtonia* is the most basal species in the Sarraceniaceae. This result was so surprising that the next major study by Bayer *et al.* (1996) repeated the sequencing of *Darlingtonia* chloroplast *rbcL*. The Bayer *et al.* (1996) study confirmed the Albert *et al.* (1992) study placement of *Darlingtonia* but shuffled around the related genera (Fig. 1c).

The reshuffling in the phylogenies reflects the minimal amount of useful data that can be obtained from studying only one or a few genes. DNA sequences that code for proteins or other cellular components are useful in phylogenetic studies of families and orders because the sequences change slowly over time. The kinds of changes seen are limited by the need of the plant to maintain a functional gene product. The DNA sequences of non-coding regions are useful for studying closely related species. They display more and different kinds of changes resulting in proportionally more useful phylogenetic information. But as species become more distantly related there can be so many changes in non-coding regions that analysis becomes difficult. These tradeoffs mean the sequence regions used in a study need to match the expected relatedness of the taxa and that enough sequence needs to be recovered to make sure there are enough meaningful changes in the data to draw valid conclusions. In addition, studies using nuclear sequences should include more than one individual per species because of the expected polymorphisms within species. As studies get more data and include additional sequence regions it is not surprising the trees change.

Owing to advances in technology Ellison *et al.* (2012) analyzed more than six times the sequence data than previous studies and tweaked the phylogeny further (Fig. 1d). The biggest change is *Roridula* being a sister group to *Actinidia*. The important aspect of this change is it puts *Roridula* and the Sarraceniaceae into an evolutionary speed perspective. *Actinidia* is a member of the Actinidiaceae, a family of about 360 species in three genera. The genera and species of the Actinidiaceae had to evolve after the split with *Roridula* and that had to happen after both split from the Sarraceniaceae. However there is no way of knowing at this point if the Ellison *et al.* (2012) phylogeny will have the last word in the families related to the Sarraceniaceae and their relationships. Future studies with even more data may result in a shuffle of the related families again.

The primary focus of the Bayer *et al.* (1996) study was species level relationships. They used the faster evolving nuclear DNA sequence: ribosomal RNA internal transcribed spacer, or ITS for short. This sequence is usually useful in separating taxa at the species level. Using ITS appeared to work for the three *Heliamphora* species tested but not for the nine *Sarracenia* species in the study. They were not able to recover enough sequence data to uniquely identify species. Neyland and Merchant (2006) made a second attempt at determining the phylogenetic relationships among the *Sarracenia* species using part of the 26S rRNA sequence plus adjacent ITS sequences. With the increased amount of sequence they were able to separate the clade consisting of *S. purpurea* and *S. rosea* from the other species in the genus and that was about it. Ellison *et al.* (2012) acquired even more nuclear sequences adding more 26S rRNA sequence as well as *PHYC*. Taken separately the Ellison *et al.* (2012) data give some hints at further species associations in *Sarracenia* but I do not consider the results significant. The major reason is not enough differences were found between species and they sampled only one individual per sequence per species.

Neyland and Merchant (2006) showed that at least for nuclear sequences it is necessary to sample more than one individual of each species when the species are as closely related as they are in *Sarracenia*. They reported on six individuals of *Sarracenia alata* and three of *S. leucophylla* as well as one individual for each of the other species. Based on the sequence data they posted to NCBI Genbank, they did not find any single site that unambiguously differentiated *S. alata* and *S. leucophylla* from the species other than *S. purpurea* and *S. rosea*. However three of the *S. alata* and one of *S. leucophylla* individuals sampled had unique base substitutions or insertions. This implies you can get a different answer by picking the right, or wrong, individual for DNA sequencing. Schnell and Krider (1976) and McPherson and Schnell (2011) comment on this state of affairs indirectly. They established sets of physical characters that define *Sarracenia* species but cautioned that the character state sets are not appropriate for determining relationships between species. Even more importantly, although they can establish an ideal for each species as they define them, when one goes out into the field, masses of hybrids are found unless a site is remote from other sites and contains only one species. And even in isolated single species sites within the extended *Sarracenia rubra* complex there are individuals that do not necessarily match the type of that particular species or subspecies.

It is now possible to do the kinds of DNA sequencing studies necessary to understand genera like *Sarracenia*. Zellmer *et al.* (2012) performed an ecological genetics demonstration study using "Next-generation" sequencing technologies designed for whole genome sequencing in a very clever way to generate a massive amount of sequence data for *Sarracenia alata*. They sequenced 86 individuals from 10 sites across the species range and compared the genetic divergence between populations to physical barriers such as the Mississippi River basin and correlated the divergence to specific local environmental factors. They estimated the eastern and western populations of *S. alata* have been separated by 60,000 generations (or a minimum of 300,000 years). However in their analysis Zellmer *et al.* (2012) made the assumption that *Sarracenia* species are reproductively isolated from each other. Four other *Sarracenia* species co-occur with *S. alata* in the eastern part of its range. Hybrids involving *S. alata* are commonly found today in Mississippi and Alabama (Sheridan 1991; McPherson & Schnell 2011). It is quite possible past hybridization resulted in introgression of genetic material into *S. alata* from other species. The presence of genetic material from other species in the eastern population would make the length of time the eastern and western populations were separated to appear longer than actually happened.

DNA sequence data provide a molecular clock according to base substitution rates. With proper scaling and reference points one can estimate dates of divergence of taxa. Ellison *et al.* (2012) used

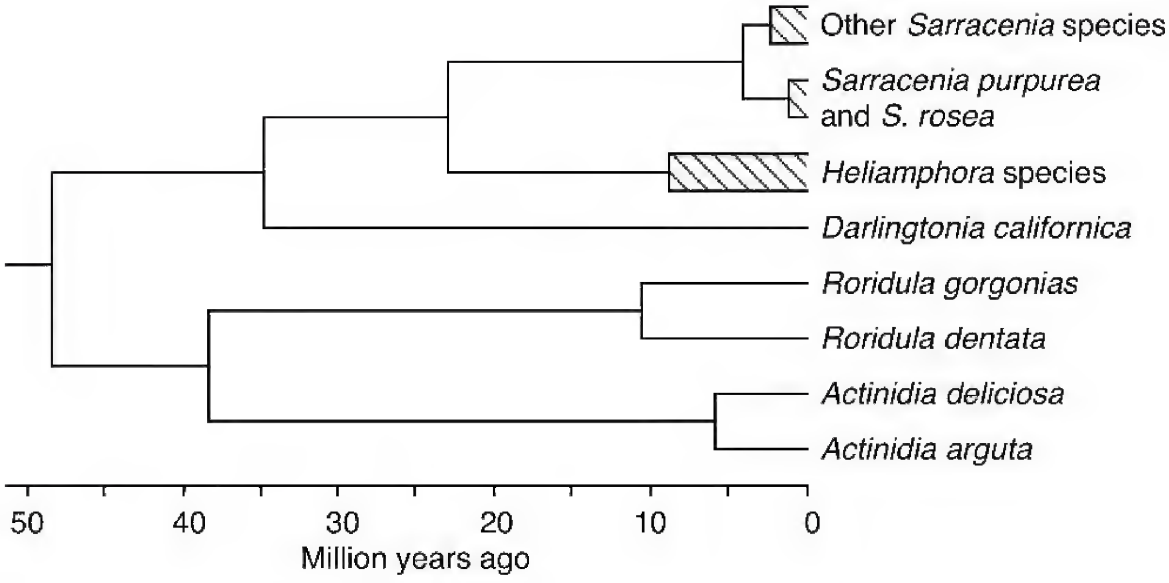


Figure 2: Phylogeny of the Sarraceniaceae calibrated to a time scale. Hatched areas indicate multiple species. Figure adapted from Ellison *et al.* (2012). Estimates of errors in the dates are not shown.

their data to put dates on events within the Sarraceniaceae to help understand the biogeography of the family (Fig. 2). To add dates they used techniques and fossil calibrations from Bell *et al.* (2010). Bell *et al*. (2010) place the first Ericales at about 120 million years ago. Coincidentally that is approximately the age of the possible pitcher plant *Archaeamphora longicervia* of Li (2005). This fossil cannot be a member of the Sarraceniaceae because it is 80 million years too old. Ellison *et al*. (2012) estimated the Sarraceniaceae came into existence between 35 and 48 million years ago. There are large uncertainties in these numbers, some of which result from scaling uncertainty and some from sampling error. Taken at face value the split between the Sarraceniaceae and *Roridula*/ Actinidiaceae clade was about 48 million years ago. The plants most likely did not have pitcher leaves at that point. Unless *Darlingtonia* developed pitchers separately from the other members of its family, by about 35 million years ago the Sarraceniaceae existed as pitcher plants. That is a time span of 13 million years to develop pitchers. The split between *Sarracenia* and *Heliamphora* is placed at about 23 million years ago, 12 million years after the *Darlingtonia* split.

The families related to the Sarraceniaceae generally have a South American focus but are by no means restricted there. *Roridula* is only found in South Africa and the species in the Actinidiaceae extant today are found in eastern Asia as well as Central and South America. During this time, although there were no confirmed land bridges between North and South America, based on fossils there was movement of mammals from South America into the Antilles and from North America into South America. These were singular events that happened well before North and South America became connected via Panama 4 million years ago. Ellison *et al.* (2012) proposed that the Sarraceniaceae arose in South America, spread to North America via the Antilles, and then fragmented first between western and eastern North America and then between eastern North America and South America. *Darlingtonia* is what is left of the western North American fragment, *Sarracenia* from the eastern North American fragment, and *Heliamphora* from South American fragment. On the other hand, Bayer *et al.* (1996) argued there is no way to discern where the Sarraceniaceae originated with any confidence. The current distribution of genera could easily be the result of two long distance dispersal events with the first event originating either in North or South America. There are plenty of

examples of plants moving between North and South America during this time without land bridges presumably by migrating birds. Although none of the species in the family have typical adaptations for attracting birds to their seeds, birds would be expected to eat the seeds on the ground. *Darlingtonia* seeds are adapted for dispersal by mammals but that could be a relatively recent development.

Of course there is no way to know the actual history of the Sarraceniaceae without more data than we have today. The results of the studies show long lines of 10 to 35 million years without any branches. That does not mean there was only one species during that time. It means with the data we have there is no evidence of the species that undoubtedly existed but went extinct. Also the branch points are not literally where a new genus or species came into being. The branch points are estimates of when two genetic lines diverged. Those separate lines may not become distinct species until much later. What the data from the Ellison *et al.* (2012) study do tell us are the approximate times of the major splits that led to the genera and species and how long the genera and species as we know them have been separate genetic entities. For *Heliamphora* Ellison *et al.* (2012) studied six species and the oldest branch point is 9 million years ago. Presuming that date holds after a study of the whole genus is published, the genus has diversified from effectively one species into 23 across 800 km in 9 million years. The *Sarracenia* species oldest branch point is 4 million years ago and the genus developed from effectively one species into 15 species and subspecies across 2000 km since that time.

In spite of these results showing very fast diversification in *Heliamphora* and *Sarracenia*, Ellison *et al.* (2012) proposed that a species was able to sufficiently exchange genetic material across the 3500 km between North and South America to remain one species over 12 million years. And what about the 14 and 19 million year intervals between the split between the genera and the recent diversification? If *Heliamphora* was really in the Guiana Highlands before the diversification was there an extinction event that reduced the genus to one species? Or were they somewhere else where they went extinct and we now only see the results of a long distance dispersal event 9 million years ago? The only evidence I see weighing on this issue is all *Heliamphora* species have an adaptation found in high elevation equatorial plants: the leaves totally wrap the apical meristem and protect it and emerging leaves from nighttime frosts. McPherson (2008) explains it is unlikely the tepuis experienced extensive freezes or frosts as freezing would have accelerated the demise of the tepuis. So why would *Heliamphora* have the feature unless it lived in an area that did get frosts at random times during the year? *Darlingtonia* and *Sarracenia* do not protect their meristem in the same way because they are adapted to a temperate environment and go dormant seasonally. For the *Sarracenia* phylogeny the situation is similar to *Heliamphora* with a long branch and then a recent explosion. If *Sarracenia* as we know it was in what today is the southeast USA it was effectively reduced to one species going forward 4 million years ago. If it was somewhere else, that is when it arrived.

Ellison *et al.* (2012) were not able to discern much structure within *Sarracenia* but within *Heliamphora* from their limited data it appears there is no correlation between physical distance between species and genetic distance. For instance they show *Heliamphora neblinae* and *H. pulchella* to be separated temporally by only 600,000 years but they are separated spatially by 600 km with no current *Heliamphora* habitat in between while *H. minor* and *H. heterodoxa*, 55 km apart, are separated genetically by the 9 million years. This implies that the *Heliamphora* species are capable of long distance dispersal, and are not relics that speciated in place as the tepuis eroded. These results are similar to the DNA study of Kok *et al.* (2012) for frogs and lizards in the Guiana Highlands and are consistent with the biogeographic studies of the Guiana Highland flora by Huber (1988) and birds by Mayr and Phelps (1967). Each of these studies discussed in general terms the implications of their work but Rull (2005) proposed an explicit model explaining their results where the biota of

Guiana Highlands have undergone elevation shifts during global climate cycles leading to mixing of species at lower elevations off the tepui tops during colder periods followed by isolation back on the tepui summits during interglacial times.

With each step in the story of the Sarraceniaceae it has gotten more complex and if anything more confusing. The comparative taxonomy got us nowhere and one could even begin wondering at what point the family developed effective pitchers and if it did so more than once. There was certainly plenty of time for independent development. The molecular genetics told us that in spite of deep roots the current set of species in *Heliamphora* and *Sarracenia* are very recent. Because all *Heliamphora* and *Sarracenia* species are interfertile and hybridization and introgression have probably been major factors in the diversification of the genera, a deeper study of their genomes using the techniques of Zellmer *et al.* (2012) with wild collected samples of multiple individuals in each population and large amounts of random sequences is necessary to go the next step in understanding evolution within these genera. The *Sarracenia* study has to be done soon before populations of pure *Sarracenia* species no longer exist. On the bright side we are only losing 4 million years of evolution when the genus *Sarracenia* has devolved into a massive hybrid swarm.

Acknowledgements: I thank the anonymous reviewers for helpful comments.

References

Albert, V.A., Williams, S.E., and Chase, M.W. 1992. Carnivorous plants: phylogeny and structural evolution. Science 257: 1491-1495.

Arne A., Anderberg, A.A., and Zhang, X. 2002. Phylogenetic relationships of Cyrillaceae and Clethraceae (Ericales) with special emphasis on the genus *Purdiaea* Planch. Org. Divers. Evol. 2: 127-137

Bayer, R.J., Hufford, L., and Soltis, D.E. 1996. Phylogenetic relationships in Sarraceniaceae based on *rbcL* and ITS sequences. Syst. Bot. 21: 121-134.

Bell, C.D., Soltis, D.E., and Soltis, P.S. 2010. The age and diversification of the angiosperms revisited. Am. J. Bot. 97: 1296-1303.

DeBuhr, L.E. 1975. Phylogenetic relationships of the Sarraceniaceae. Taxon 24: 297-306.

Ellison, A.M., Butler, E.D., Hicks, E.J., Naczi, R.F.C., Calie, P.J., Bell, C.D., and Davis, C.C. 2012. Phylogeny and biogeography of the carnivorous plant family Sarraceniaceae. PLoS ONE 7(6): e39291. doi:10.1371/journal.pone.0039291.

Franck, D.H. 1976. Comparative morphology and early leaf histogenesis of adult and juvenile leaves of *Darlingtonia californica* and their bearing on the concept of heterophylly. Bot. Gaz. 137(1): 20-34.

Goebel, K. 1891. Pflanzenbiologische Schilderungen. Part 2, V. Insektivoren. Marburg.

Huber, O. 1988. Guayana lowlands versus Guayana highlands, a reappraisal. Taxon 37: 595-614.

Kok, P.J.R., MacCulloch, R.D., Means, D.B., Roelants, K., Van Bocxlaer, I., and Bossuyt, F. 2012. Low genetic diversity in tepui summit vertebrates. Current Biology 22(15): R589-R590.

Li, H. 2005. Early Cretaceous sarraceniacean-like pitcher plants from China. Acta Bot. Gall. 152: 227-234

Lloyd, F.E. 1942. The Carnivorous Plants. Chronica Botanica, Waltham, MA.

Macfarlane, J.M. 1889. Observations on pitchered insectivorous plants. (Part I.). Annals of Botany 3(10): 253-266.

Macfarlane, J.M. 1893. Observations on pitchered insectivorous plants. (Part II.). Annals of Botany 7(4): 403-455.

Mayr, E., and Phelps, W.H. 1967. The origin of the bird fauna of the South Venezuelan Guayana. Bulletin of the American Museum of Natural History 136: 273-327

McPherson, S. 2008. Lost Worlds of the Guiana Highlands. Redfern Natural History Productions Ltd., Poole.

McPherson, S., and Schnell, D. 2011. Sarraceniaceae of North America. Redfern Natural History Productions Ltd., Poole.

McPherson, S., Wistuba, A., Fleischmann, A., and Nerz, J. 2011. Sarraceniaceae of South America. Redfern Natural History Productions Ltd., Poole.

Neyland, R., and Merchant, M. 2006. Systematic relationships of Sarraceniaceae inferred from nuclear ribosomal DNA sequences. Madroño 53: 223-232.

Renner, S.S. 1989. Floral biological observations on *Heliamphora tatei* (Sarraceniaceae) and other plants from Cerro de la Neblina in Venezuela. Plant Syst. Evol. 163: 21-29.

Rull, V. 2005. Biotic diversification in the Guayana Highlands: a proposal. J. Biogeogr. 32: 921-927.

Schnell, D., and Krider, D.W. 1976. Cluster analysis of the genus *Sarracenia* L. in the southeastern United States. Castanea 41: 165-176.

Sheridan, P.M. 1991. What is the identity of the west gulf coast pitcher plant, *Sarracenia alata* Wood? Carniv. Pl. Newslett. 20(4): 102-110

Zellmer, A.J., Hanes, M.M., Hird, S.M., and Carstens, B.C. 2012. Deep phylogeographic structure and environmental differentiation in the carnivorous plant *Sarracenia alata*. Syst. Biol. 61(5): 763-777.

Keywords: cultivar: *Sarracenia* 'Waccamaw', *Sarracenia flava* var. *rugelii* 'Bob Hanrahan'

Sarracenia 'Waccamaw'

Submitted: 25 April 2013

This exceptional clone of *Sarracenia flava* var. *atropurpurea* is a superb representative of the uncommon variety native to the Green Swamp of North Carolina, USA. The clone was originally imported to New Zealand as vegetative material by the Christchurch Botanical Gardens *circa* 1980. It was subsequently obtained by me in 1987. It has been maintained solely *via* vegetative propagation since that time in order to preserve its distinctive properties.

Representative of the form of *S. flava* varieties native to the east coast of the species range, a strong flush of pitchers follows typical *S. flava* flowers produced during early spring. The clone readily produces rhizome divisions with two or three pitchers emergent from each rhizome growth point. Phyllodia, typical *S. flava* in form, are produced during late autumn and endure through winter.

The pitchers attain a height of 60-80 cm. From the outset of pitcher growth, under optimal conditions of maximum possible sunshine, exterior coloration is a uniform bright red throughout the length of the pitcher including the outer hood (Fig. 1). It is noteworthy by contrast that once the pitcher opens, the nectar roll, the interior of the pitcher, the column, and the underside of the hood are bright yellow. Superimposed on the bright yellow interior surface is a network of bright red veining. A feature of the column is a prominent central red vertical stripe. Accompanying the red stripe are red veins that follow from the interior of the pitcher rising upward through the column branching out into the surface of the underside of the hood (Fig. 2). The outer margin of the hood is without undulations. As the growing season progresses, by mid-summer the bright yellow surfaces become infused with a varying degree of red. Autumn phyllodia also attain a reddish coloration under optimal light conditions. This sum of features reflects those recorded in the wild (Schnell 1998; Fowler 2008a,b).

Figure 1: *Sarracenia* 'Waccamaw' plant. Photo by Julian D. Brook.

The name 'Waccamaw' is in reference to Lake Waccamaw which is within the confines of the Green Swamp, North Carolina, being the native habitat of the *Sarracenia flava* var. *atropurpurea*.

Vegetative propagation is necessary to maintain the unique features of this cultivar.

Figure 2: *Sarracenia* 'Waccamaw' front (left) and rear views (right). Photos by Julian D. Brook.

References

Schnell, D. 1998. *Sarracenia flava* L. varieties. Carniv. Pl. Newslett. 27(4): 116-120.

Fowler, J. 2008a. Green Swamp Orchids and Carnivorous Plants. http://www.pbase.com/jimfowler/20080511greenswamp, accessed 28 April 2013.

Fowler, J. 2008b. Day trip to the Green Swamp, North Carolina. http://www.pbase.com/jimfowler/20080504greenswamp, accessed 28 April 2013.

—Don Gray • Auckland • New Zealand • don.gray@xtra.co.nz

Sarracenia flava var. *rugelii* 'Bob Hanrahan'

Submitted: 12 June 2013

In the early 1990's, Peter received what looked like a typical *Sarracenia flava* var. *rugelii* from Bob Hanrahan. As it grew in the collection at California Carnivores, it became quite evident that there was nothing typical about this plant. Damon remembers as a boy noticing it in the collection and remarking to Peter about its striking beauty and size (Fig. 3).

It's a nice tall clone, growing up to 80 cm tall. We have a few *S. flava*'s that grow a bit taller, but none that are as elegant as this one. The tall pitchers are a yellow-green so bright that they seem to glow in the vernal sunlight as they emerge. The only splash of red is a solid patch in the throat, typical of the *rugelii* variety. Perfectly grown plants may also have a thin red picotee along the front edge of the lid. The mouth of the pitcher flares wide like a trumpet and the lip has a deep cleft in the front, which also adds to its regal appearance.

Figure 3: *Sarracenia flava* var. *rugelii* 'Bob Hanrahan' pitchers and lid. The hand of young CP grower David Green for scale.

It is the ridiculously huge lid, however, that really sets this clone apart. The large mature pitchers have an undulating lid that can be just over 15 cm across! There's a childlike joy you get from putting your hand atop the pitchers and seeing it fit nicely across the gigantic lid (Fig. 3). It has a simple and classic beauty reminiscent of the modern columns designed by Frank Lloyd Wright, which seem too tall and top heavy to stand. Peter and Damon both agree that it is the most perfect *S. flava* var. *rugelii* that we have ever grown or seen. It produces only a few pitchers per growth point, probably due to the high energy costs of producing pitchers so large and spectacular. The flowers are typical of *S. flava* with long yellow petals.

It is with much love and respect that we name this plant in honor of our friend Bob Hanrahan. He gave so much to California Carnivores in the early days and to the hobby of growing carnivorous plants in general; we might not even be here today if it weren't for his generosity and enthusiasm over the years. When we heard of his passing, we knew that we would have to name one of the very best plants in our collection for him. This seems a fitting choice, as it has long been one of our all-time favorite plants and its tall, stately pitchers remind us of Bob himself.

Previously, this plant has been labeled as *Sarracenia flava* var. *rugelii* "Big Lid", however, this old name shall no longer be used hereafter.

We are in the process of establishing this clone into tissue culture, so that everyone may have the pleasure of growing this wonderful plant. True *Sarracenia* 'Bob Hanrahan' should only be vegetatively propagated. Seeds obtained by selfing or out-crossing will probably not be true.

—Damon Collingsworth • Peter D'Amato • California Carnivores • 2833 Old Gravenstein Hwy • Sebastopol, CA 95472 • califcarn@aol.com

Book review

by Marcel van den Broek • marcel@carnivorousplants.org

Bailey, T., and McPherson, S. 2013. *Dionaea* The Venus's Flytrap. Redfern Natural History Productions Ltd. 448 p. ISBN 978-1-908787-10-1.

Among the recent avalanche of books on carnivorous plants is this book that is completely dedicated to just one plant, the Venus's Flytrap. The authors, Tim Bailey and Stewart McPherson, are two well-known carnivorous plant enthusiasts. This review is my impression of the book, while comparing it to Tim Bailey's previous work on this species: Miraculum Naturae: Venus's Flytrap (Bailey 2008).

This new book displays the well known Redfern quality in being glossy, full of high quality color photographs and above all, thick/heavy. The content is largely comparable to Bailey's Miraculum Naturae, something the current authors readily acknowledge. It was their intent to produce an improved version of Bailey's book and to add new material as well. In this they undoubtedly succeeded. Bailey's original book was a private publication on a tight budget and the difference with this new book shows. A hard cover, beautiful full color photographs on high quality paper, and a much clearer print are the first things that are noticeable in a comparison.

The book starts with a general introduction to carnivorous plants, like every other Redfern book, as this might be your first book on carnivorous plants. If not, just skip this section as it is just about the same as in all other Redfern books, though somewhat shorter.

Next, the book has a somewhat lengthy history lesson. If you are interested in the botanical history of plants you will love it, but for the average reader 60 pages of history on a single plant might be a bit too much. The text is just about the same as in Miraculum Naturae, but here the quality of print and the use of color actually improves on the earlier publication because details on pictures of old letters are much more discernible. Biographies of the historically important people in *Dionaea*'s history are found in the back of the book for those who want yet a little more history.

Next is a pretty good text on such things as growth cycle, cultivation, and pests and diseases. The section on the conservational status of *Dionaea* is very clear, rating remaining populations on survivability with nice maps that show a depressing pattern of decline.

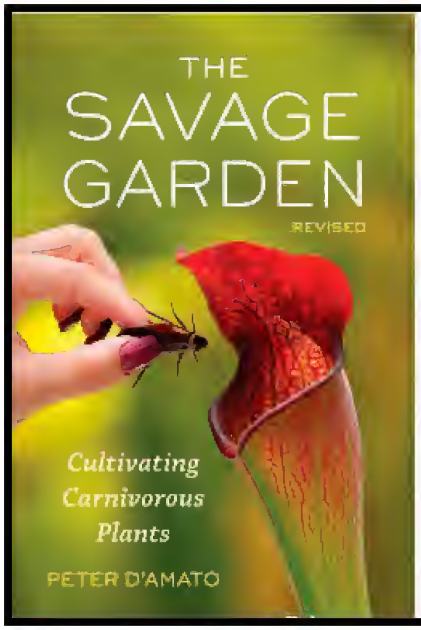
Up to this point, this book is a natural history lesson combined with a reasonably good overview on *Dionaea*, but not something that couldn't be found elsewhere. The real value of this book comes in the cultivar section where many of the commonly grown variations of *Dionaea* are described, including all officially registered cultivar names as of the date of print. For many of the plant names that had not yet been registered, this is the first time anyone has made a formal description of these plants. These descriptions, combined with the high quality pictures that accompany the text, make this a valuable publication for those who grow these plants.

In conclusion, I can only state that this is a book that displays what might be a new course for books by Redfern/McPherson. It straddles the fence between a scientific monograph and a popular horticultural book, thus reaching out to two very different types of readers. As with all fence sitters, both communities of readers will have some issues with this book as it tries to be both, but isn't perfect for either side. However, the clear lay out of the book makes it easy to skip sections that one might find to be less interesting and the (as usual) friendly price makes the book worthwhile to both groups. This is a book along the same lines as that other (excellent) Redfern publication, *Aldrovanda*: The Waterwheel Plant by Adam Cross (2012).

References:

Bailey, T.S. 2008. Miraculum Naturae: Venus's Flytrap. Trafford Publishing: Bloomington, IN. 280 p.

Cross, A. 2012. *Aldrovanda*: The Waterwheel Plant. Redfern Natural History Productions: Dorset, UK. 249 p.



California Carnivores is delighted to announce that the newly revised "Savage Garden" is now available !

For fifteen years, The Savage Garden has been the bestselling, award-winning bible for those interested in growing carnivorous plants. This new edition is fully revised to include the latest developments and discoveries in the carnivorous plant world, making it the most accurate and up to date book of its kind.

Now with 48 more pages and lots more photos, most taken by our own Damon Collingsworth !

. . . and now with the metric system too !

Order your autographed copy today at

www.CaliforniaCarnivores.com

ExoticPlantBooks.com

Two NewField Guides

Genlisea

Dionaea
The Venus's Flytrap

Low Prices - Fast Shipping - Easy Ordering

1-855-838-2233 | info@exoticplantbooks.com

THE

ICPS SEED BANK

an exclusive member benefit

The International Carnivorous Plant Society offers its members exclusive access to a variety of carnivorous plant seeds. Seeds are ordered online at the ICPS Store:

http://icps.clubexpress.com

The Seed Bank cannot exist without seed donations. Information about growing carnivorous plants from seed and donating seeds to the Seed Bank are at the ICPS public web site:

http://www.carnivorousplants.org

If you do not have access to the Internet, please send seed order form requests to:

International Carnivorous Plant Society, Inc.
2121 N. California Blvd., Suite 290
Walnut Creek, CA 94596-7351, USA

JOHN BRITTNACHER, Seed Bank Manager, john@carnivorousplants.org

Finepix